Javier Lopez-Gomez

HPC/low-level Software Engineer

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Professional Profile

Experienced HPC and low-level C/C++ software engineer with expertise in Operating System internals, Microcontroller firmware, and Compiler design / implementation. Highly motivated, fast learner. Enjoys the development of complex software systems where efficiency matters.

Languages

Spanish	Native
English	C1
German	A1
French	A1

Skills

Compiler Design / LLVM / clang	●●●●○
Debugging (gdb, lldb) / Reverse Engineering / Assembly	●●●●○
OS Architecture / Linux kernel	●●●●○
Embedded / Microcontroller-based Systems	●●●●○
Software and Network Security / TCP/IP stack	●●●●○
Technical Writing / Presentation	●●●●○
C/C++	●●●●●
Python / bash / AWK	●●●●○
GTK+ / Xlib	●●●○○
MPI	●●●○○
Win32 API	●●●○○
Git internals	●●●●●

Experience

2020–2023 **Senior Applied Fellow (Software for Experiments group, ROOT project)**, *European Organization for Nuclear Research (CERN)*, Geneva, Switzerland.

Detailed achievements:

- Contributions to RNTuple (the next-generation columnar I/O system for high-energy physics), outperforming HDF5 and Apache Parquet up to a factor of $2.2\times$. Specifically:
  - A storage backend for the Intel DAOS object store that provides up to $\times 16$ improvement over DAOS dfuse compatibility layer
  - A mechanism to allow for incremental updates of the data schema, a unique feature not present in other columnar storage solutions
  - Further improments in order to satisfy the requirements of the ATLAS LHC experiment, e.g. per-field post-read hooks and extensions to the type system. Liaison person for ATLAS I/O requirements.
  - Support for big-endian architectures and partial contributions to the design of zero-copy file merge
- Notable contributions to the cling LLVM-based C++ interpreter, e.g. supporting entity redefinition and general improvements to the unloading infrastructure
- Supervision of 5+ interns, mentor for CERN-HSF Google Summer of Code, and user training and support

2017–2020 **Predoctoral contract (Computer Architecture and Technology Area)**, *University Carlos III of Madrid*.

Detailed achievements:

- Contributed a prototype implementation of C++ contract-based programming for clang, demonstrating that contracts may make some libstdc++ functions $\sim 15\%$ faster
- Teaching Assistant in Real Time Systems, Operating Systems Design, Operating Systems, and Distributed Systems, achieving an average score of 4.23 out of 5 in the teacher evaluation surveys
- Held additional office hours on Real Time Systems and Operating Systems Design as part of the UC3M–PIEI International Students Programme 2018–2019
- July 2018 thesis defense committee member for BSc in Audiovisual System Engineering
- Advisor in 4 theses (BSc in Computer Science and Engineering)

2012–2013 **Associate Engineer (devtools)**, *Tuenti Technologies S.L.*, Madrid.
Detailed achievements:

- Co-authorship of a program to generate test fixtures based on anonymized real-world data, aiding in improving the test coverage
- Developed a utility for automated detection of mismatching application backend–database schema, assessing potential deployment issues
- Contributed a tool to characterize the development environment

2006–2011 **System Administrator and Software Developer**, *Grupo Microsyscom*, Madrid.
Detailed achievements:

- Took the administration of Debian GNU/Linux and FreeBSD, incl. ISC dhcpd, BIND9, Apache httpd, MySQL, and Squid services for 5–10 external clients, ensuring continued service; VPN (IPsec) and VoIP deployment. Incident response.
- Implemented a RFB connection hub that relays data between a pair of RealVNC endpoints associated to a session identifier, reducing the time to start controlling a remote desktop by at least $5\times$
- Contributed to the automated migration from BIND9 to 4PSA DNS Manager

Education

2017–2020 **Ph.D. in Computer Science and Technology**, *University Carlos III of Madrid*.
Dissertation: "Balancing Perfomance and Reliability in Software Components",
graduated with honors – Cum laude
Research Stay: Jul 2019–Oct 2019 at CERN, for the ROOT project (EP/Software for Experiments group)

2016–2017 **M.Sc. in Computer Science and Technology**, *University Carlos III of Madrid*.
Thesis: "Automatic Classification of Drivers and Driving Style Using ECU Diagnostic Data"

2006–2011 **B.Sc. in Computer Science and Engineering**, *University Carlos III of Madrid*.
Thesis: "fsniff: A software suite for capturing and analyzing application I/O", graded as passing with honors

Selected Publications

Scientific Journals / Conferences

- **A caching mechanism to exploit object store speed in High Energy Physics analysis**. Cluster Computing (2022).
- **Exploring Object Stores for High-Energy Physics Data Storage**. In 25th International Conference on Computing in High Energy and Nuclear Physics (CHEP 2021).
- **Relaxing the one definition rule in interpreted C++**. In Proceedings of the 29th International Conference on Compiler Construction (CC 2020).
- **Detecting semantic violations of lock-free data structures through C++ contracts**. The Journal of Supercomputing volume 76, pages 5057–5078 (2020).
- **Exploring stream parallel patterns in distributed MPI environments**. Parallel Computing, Volume 84, Issue C, May 2019, pp 24–36.

Industrial Conferences

- **Adding support for C++ contracts to Clang**. 2019 European LLVM Developers Meeting (EuroLLVM'19).

An extended list of publications, talks, and open-source contributions is accessible at `https://jalopezg.dev/`.